

Remarks

Examiner Carrillo is thanked for the thorough Office Action.

In the Claims

The claims have not been further amended.

Claim Rejections

The Rejection Of Claims 1 To 18 Under 35 U.S.C. §103(a) as Being Unpatentable Over Sasaki et al. (U.S. Patent 5,770,095) In View Of Ng et al. *Synthesis of Some Carbonyl Derivatives of BTA and Determination of Their Inhibitive Properties for Copper in 3% NaCl Solution*, Corrosion Science and Protection Technology, Vol. 9 (3), July 1997, pp. 201-204

The rejection of claims 1 to 18 under 35 U.S.C. §103(a) as being unpatentable over Sasaki et al. (U.S. Patent 5,770,095) (the '095 Sasaki Patent) in view of Ng et al. *Synthesis of Some Carbonyl Derivatives of BTA and Determination of Their Inhibitive Properties for Copper in 3% NaCl Solution*, Corrosion Science and Protection Technology, Vol. 9 (3), July 1997, pp. 201-204 (the Ng Article) is acknowledged.

Applicants' wish to briefly point up the claimed *combination* of limitations of their invention which are believed to be not shown nor obvious from the

teachings of known references in this field. The independent claims all clearly define polishing a metal layer having recessed portions using a slurry including a polishing agent containing: a chemical agent including at least a *carbonyl derivative* of benzotriazole, the chemical agent forming a protective film on the surface of the metal layer; and an etching agent for etching the metal layer.

The '095 Sasaki Patent describes a CMP metal polishing method using a slurry including a polishing agent containing: a chemical agent including "*benzotriazole ... (BTA), BTA derivatives including tryltriazole (TTA) which is prepared by substituting a hydrogen atom of a benzene ring of BTA with a methyl group,...*" that forms a protective film on the surface of the metal layer; and an etching agent of H₂O₂, HF and an amino acid for etching the metal layer. Sasaki, Col. 3, lines 38 to 44.

The instant Inventors specifically noted in the Detailed Description of the Preferred Embodiment:

While the 5,770,095 U.S. Patent to Sasaki et al. (hereinafter the Sasaki Patent) discloses using benzotriazole (C₆H₅N₃) (BTA) (See Fig. 1A) or tryltriazole (C₇H₇N₃) (TTA) (See Fig. 1B for its four variations), or a mixture of BTA and TTA, among others, as a chemical agent specific to the material of the target film within a CMP polishing agent so as to form a protective film on the target film to suppress the isotropic chemical polishing, *the present inventors have discovered that when copper (Cu) is polished by CMP with BTA and/or TTA, the protection of Cu is still not enough that causes Cu dishing and non-uniform Cu surfaces. Use of BTA and/or TTA, for example in accordance with the Sasaki Patent, in a CMP method causes formation of Cu(I)BTA Cu surface complexes that is the protective film that suppresses the isotropic chemical polishing.* (emphasis added)

Page 10 of the instant Specification as filed.

The instant Inventors then disclose in the instant specification as filed:

The present inventors have discovered that by using carbonyl derivatives of benzotriazole as a chemical agent in a polishing agent within a CMP slurry instead of benzotriazole (or tryltriazole (TTA)), greater Cu protection capability is achieved over just BTA. *This is postulated to be primarily due to the increase of steric bulkiness and hydrophobicity of the substituted carbonyl group, thereby blocking oxidants from the Cu by the sterically bulky and / or hydrophobic carbonyl group of the BTA-carbonyl ligands. (See Fig. 5)* The flow chart of Fig. 3 should be referred to in conjunction with Figs. 4A - 4C that schematically illustrate the steps of the present invention's Cu CMP method. (emphasis added)

Page 11 of the instant Specification as filed.

Applicants respectfully submit that Sasaki's disclosure of using a chemical agent including "BTA derivatives including tryltriazole (TTA) which is prepared by substituting a hydrogen atom of a benzene ring of BTA with a methyl group" is not a sufficient teaching of using *any* BTA derivative, in fact such "BTA derivatives" so disclosed are limited to such derivatives such as TTA but not to, for example, carbonyl derivatives of BTA since the phrase "including tryltriazole (TTA) which is prepared by substituting a hydrogen atom of a benzene ring of BTA with a methyl group" limits "BTA derivatives."

The Ng Article describes the synthesis of seven (7) types of carbonyl derivatives of benzotriazole (BTA).

As noted above, the '095 Sasaki Patent does not disclose using a chemical agent including a carbonyl derivative of benzotriazole and while the Ng Article describes carbonyl derivatives of benzotriazole there is no teaching to combine these references. Sasaki specifically teaches using "BTA [benzotriazole], a BTA derivative such as a derivative prepared *by substituting a hydrogen atom of a BTA benzene ring with a methyl group*, and a mixture containing the aforementioned compounds are

particularly effective when Cu or a Cu alloy is employed as the material containing a metal as a main component." Col. 3, lines 57 to 62.

Therefore independent claims 1, 8 and 14 distinguish over the '095 Sasaki Patent in view of the Ng Article under §103(a) for the above reasons and further, the prior art lack a suggestion that the reference should be modified in a manner required to meet the claims; the Examiner has not presented a convincing line of reasoning as to why the claimed subject matter as a whole, including its differences over the prior art, would have been obvious; the prior art references do not contain any suggestions (express or implied) that they be combined, or that they be combined in the manner suggested; and each reference is complete and functional in itself, so there would be no reason to use parts from or add or substitute parts to any reference.

Claims 2 to 7 depend from independent claim 1; claims 9 to 13 depend from independent claim 8; and claims 15 to 18 depend from independent claim 14; and are believed to distinguish over the combination for the reasons previously cited.

Therefore claims 1 to 18 are submitted to be allowable over the cited references and reconsideration and allowance are respectfully solicited.

CONCLUSION

In conclusion, reconsideration and withdrawal of the rejections are respectively requested. Allowance of all claims is requested. Issuance of the application is requested.

It is requested that the Examiner telephone Stephen G. Stanton, Esq. (#35,690) at (610) 296 – 5194 or the undersigned attorney/George O. Saile, Esq. (#19,572) at (845) 452 – 5863 if the Examiner has any questions or issues that may be resolved to expedite prosecution and place this Application in condition for Allowance.

Respectively submitted,



Stephen B. Ackerman

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